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The growth of camellia in growth media containing composted organic wastes of peanut

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ABSTRACT

An experiment based on randomized completely blocks design was conducted to investigate the impact of peanut shelles compost as the growth medium of Camellia. The different ratios of peanut shelles compost (PSC) containing control (without PSC), 20, 40, 60 and 100% v/v of PSC were used. Five treatments, every treatment at 3 replicates and 15 plots were used for experiment. The rooted cuttings of Camellia were planted and periodic watering was performed 2 times per week. After 5 months, the plants growth indices were measured. Results showed that the increase of PSC in the planting bed was led to increase in the growth indices of Camellia plant as compared with control. The growth of plant was better at 40% PSC, but using 100% PSC decreased the growth.

Key words: Compost, Ornamental, Peanut, Pot experiment.

INTRODUCTION

The use of peat as a growth medium of ornamental plant is doubtful due to ecological damages to environmental and economic advantageous for ornamental plants producers. These factors caused those researchers think to beds with high quality and cheap instead of peat [1]. Million tons of different agriculture wastes being produced annually across the country that can has role on preparing organic materials but unfortunately major part is burned or leaved somewhere and leads to environment pollution [2]. With increasing awareness of environmental dangerous of wastes, in addition to need to sanitary landfill or recycle them and also in order to decrease useof non-renewable sources like peat, further use of composted biosolids has been suggested in farming [3,4]. Some studies showed that the peat can be replaced by organic wastes such as municipal wastes, sewage sludge, livestock manure, paper, waste of pruning and fungi beds and other organic waste after composting [5]. Investigations on *Ficus benjamina* variety Starlight in a growth medium contains one part peat and one olive waste (as volume) showed that the highest height of plant has obtained during 10 month growth [6]. Papafotiou et al. [4] used olive wastes compost as alternative of peat to cultivate some ornamental plants and suggested that this compost can be replaced amounted 25%, 75% and 75% v/v instead of peat for cultivating *Ficus benjamina*, *Cordyline* and *Syngonium podophyllum*, respectively. Application of manure, wood chips and paper wastes mixed with volcanic material in providing cultivation bed of *Croton (Codiaeum variegatum)* and Chrysanthemum showed that these materials can be used as planting bed [7]. The bark of broad leaf and conifer trees, sewage sludge, sawdust, mushroom compost, municipal wastes compost are the materials that can be used as planting beds [8,9,10].

Peanut shelles as remained wastes of cultivating peanut has considerable volume which its compost can be used as available sources of ornamental plants medium. Cultivated area of peanut in Iran is about 3218 hectares which 2718 hectares is located in Guilan province. It is estimated to produce about 3388-3873 tons peanut shelles wastes in Iran

in every year [11]. Thus, there is a high extent import of peanut in Iran. Therefore, it has been decided to evaluate the possibility using this organic waste as a growth medium of Camellia.

MATERIALS AND METHODS

An experiment based on randomized completely blocks design was conducted to investigate the impact of peanut shelles compost as the growth medium of Camellia. Five growth media was used include:

1. 50% perlite + 50% sand (v/v)
2. 20% peanut shelles compost + 40% perlite + 40% sand (v/v)
3. 40% peanut shelles compost + 30% perlite + 30% sand (v/v)
4. 60% peanut shelles compost + 20% perlite + 20% sand (v/v)
5. 100% peanut shelles compost

Five treatments, every treatment at 3 replicates and 15 plots were used for experiment. The rooted cuttings of Camellia with the same size and height of 20 cm and the leaves number of 5-7, were prepared. The experiment duration was 5 months to appear the buds. Perlite with a diameter of 1 to 2 mm (fine) was used and sands of the river have been washed to be free from any mud. Peanut shelles compost was prepared from Lahijan's Ornamental Flowers and Plants Research Station. In the beginning, FC (field capacity) of pots was measured to determine irrigation water requirement per pot in each time period, that this rate was 250 ml. Periodic watering was performed 2 times per week.

The plants were harvested after 5 months and the plant height, stem diameter, flower bud number; fresh and dry shoot and root weight were measured at every treatment. The sub samples of dry leaves (at 70°C for 48 h) were ground and then dry-ashed in a furnace at 550°C and then extracted with 2M HCl. The concentrations of Fe, Mn and Zn were measured in the extracts by atomic absorption spectrophotometry, K by flame photometry, and P by spectrophotometry. Total kjeldahl nitrogen (TKN) of leaves and PSC and the total organic carbon (TOC) of the PSC were estimated by using a microkjeldahl method [12] and Walkey and Blacks Rapid titration method [13], respectively. Table 1 indicated some properties of PSC (Peanut Shelles Compost) used in experiment. The pH and EC of PSC was determined on a water extract from compost using compost to water ratio of 1:5 by weight. Thus, the phosphorus and potassium of PSC were determined by spectrophotometric and flame photometric methods, respectively.

Table 1. Some properties of PSC (Peanut Shelles Compost) used in experiment

Property	PSC
Total Nitrogen (%)	2.76
Total Phosphorus (%)	0.67
Total Potassium (%)	1.48
Organic Carbon (%)	27.1
C/N ratio	9.8
pH (1:5)	5.06
EC (dS/m)	4.30

The experiment was a completely randomized design in three replications and MSTATC software was used for variance analysis of data by Least Significant Difference (LSD) test.

RESULTS AND DISCUSSION

The results of Table 2 showed the effect of treatments on the growth indices of plant is significant at 1% level. The effect of planting substrates on the growth indices includes leaf numbers, plant heights, root dry weights and shoot dry weights is observed in figures 1, 2, 3 and 4, respectively. The results showed that the growth of Camellia plants in the treatments of 40 and 60% peanut shelles compost was more than control and 100% peanut shelles. The achieved results were accordance to the results of Abad et al. [14] and Mahboub Khomami and Padasht [15]. Padasht [16] survey the different effects of bark, tea wastes, municipal waste compost and rice hull on the growth of Beaucarnea and Dracaena and concluded that these compounds significantly increased the number of leaves, plant height and other growth parameters. Chen et al. [6] found that the preference of compost substrates is due to the high level of nutrients and microbial population in the root Rhizosphere lead to more growth.

Table 2. The analysis variance of data related to effect of treatments on plant growth indices

Variation resources	Freedom degree	Mean Squared			
		Leaf number	Plant height	Dry weight of root	Dry weight of shoot
Growth medium	4	91.4 **	97.5 **	4297.2 **	29.9 **
Error	24	11.8	22.1	4569.9	0.39

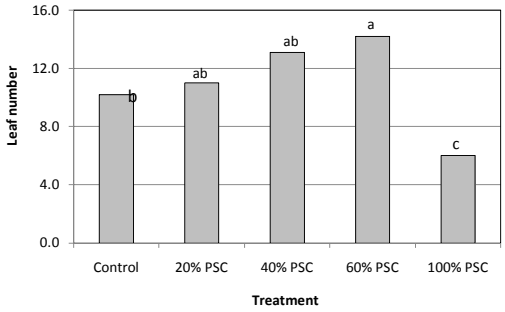

Figure 1. Effect of treatments on leaf number

The growth of plant decreased significantly in 100% Peanut shelles as compared with control and other treatments of Peanut shelles compost. It seems that in 100% Peanut shelles compost, the amount of plant growth decreased due to the high percentage of pores and reduction of water retention capacity and increasing of salinity. A desirable bed must have a proper water retention capacity. The more growth of roots in the 40 and 60% Peanut shelles compost can have a major role on the effectively uptake of water and nutrients in the future, in addition to the establishment of the plant. The parts of compost impacts can be due to humic materials. Chen et al [6] also stated that the part of the effects of compost on growth of Ficus benjamina could be due to a similar role in plant growth regulators. Accordingly, the root growth of the plant has increased in the presence of compost in the growth medium and improvement of bed physical conditions.

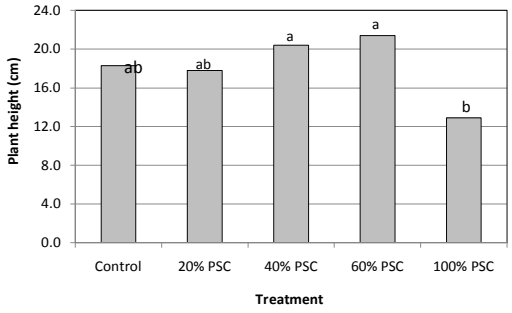

Figure 2. Effect of treatments on the height of plant

Table 3 shows results of variance analysis of data related to the effect of treatment on nutrients concentration of shoot. The effect of treatment on iron and zinc concentration wasn't significant at 5% level. Table 4 indicated effect of treatments on the concentration of nutrients in shoot.

Table 3. The analysis variance of data related to effect of treatments on nutrients concentration of shoot

Variation resources	Freedom degree	Mean Squared					
		Nitrogen	Phosphorus	Potassium	Iron	Zinc	Manganese
Growth medium	4	0.43^{**}	0.041^{**}	3.39^{**}	1650.7^{ns}	16.5^{ns}	115.7^{**}
Error	36	0.24	0.005	0.54	920.8	8.2	29.8

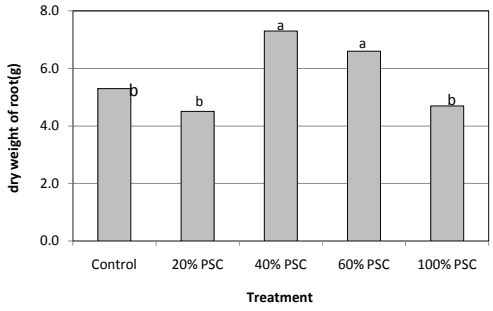

Figure 3. Effect of treatments on dry weight of root

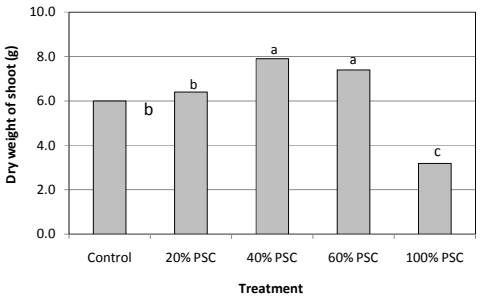

Figure 4. Effect of treatments on dry weight of shoot

Table 4. Effect of treatments on the concentration of nutrients in shoot

Treatment	Nitrogen	Phosphorus	Potassium	Iron	Zinc	Manganese
PSC_0	2.65 ab	0.43 b	2.41 c	71.8 a	7.1 b	16.1 ab
PSC_{20}	2.95 a	0.43 b	2.81 bc	100.6 a	10.4 a	11.2 b
PSC_{40}	2.66 ab	0.54 a	3.75 a	81.4 a	7.7 ab	14.0 b
PSC_{60}	2.84 ab	0.41 b	3.30 ab	98.1 a	9.3 ab	11.5 b
PSC_{100}	2.38 b	0.55 a	2.29 c	102.3 a	9.6 ab	19.8 a

An important point is increase in potassium concentration of shoot remarkably than in the control. Increase in K concentration is 1.55 and 1.36 times higher than control in 40 and 60% PSC treatments, respectively. The results of this study were consistent with the results of Alidust [17]. Also it has been reported that vermicompost affect on the increase in potassium uptake in the medical plants of Chamomile [18]. The similar results were reported on the confirmation of the effect of vermicompost on the increasing of potassium uptake in the tomatoes that it is effective on the microbial activity improvement, the existence of plant growth regulator and increasing uptake of mineral elements such as potassium [19].

As regards, the nutrient concentration in the plants organ affected by different factors like plant growth, ionic competence and deposition, sometimes it cannot use from elements concentration in plant as a reliable parameter for examining of plant growth. In this regard, the use of nutrient uptake by plants from the soil is a more reliable parameter. Since the uptake rate obtained from multiplying of nutrient concentration of plants and dry weight of plant, therefore, nutrient dilution effect disappears. Dilution effect on the plant growth and reduction of ingredients concentration in plant are due to increase in plant size (plant growth).

In general, the results showed that peanut shelles compost increases the growth indices of Camellia plant. Increasing of peanut shelles compost to 100% was led to decrease in growth and quality of plant. This organic waste had a considerable on potassium concentration in shoot. It is suggested that this bed mixed with low pores beds and it can be used as an alternative imported beds.

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